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a nitride liner recessed within said trench such that an uppermost surface of said nitride liner is below a channel depth, said channel depth being representative of a depth of a channel associated with a device disposed beside said trench, the nitride liner being below the channel depth prevents charge trapping in the shallow trench isolation structure due to the channel;

an oxide fill disposed above said nitride liner, such that said oxide fill extends above and below the uppermost surface of said nitride liner substantially to a top surface of said substrate and completely filling below the uppermost surface, respectively; and

the oxide fill is disposed above said liner such that polysilicon material used in other processing is prevented from entering the trench.

25. (New) The structure of claim 24, wherein the oxide fill includes tetraethylorthosilicate.

REMARKS

This application has been reviewed in light of the Office action dated October 16, 1998 and the Advisory Action dated June 1, 1999. Claims 1-5, 7-8, 10 and 24 and 25 are pending in the application. Since the previous amendments were not entered, claims 6, 9 and 11 have been canceled without prejudice. Claim 1 has been amended to include the subject matter of claim 6, and Claim 8 has been amended to include the subject matter of claims 9 and 11. Claims 7 and 10 has been amended to change their dependency. Claims 24 and 25 have been added. No new matter has been added by the amendments. The examiner's reconsideration of the rejection in view of the amendments and the following remarks is respectfully requested.

By the office action, claims 1-5, 7-8 and 10 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Fukuda (Japanese Patent No. 57-159038 hereinafter Fukuda) in view of Wolf. The Examiner stated that Fukuda includes the claimed trench isolation structure in FIGS. 4a-4e of Fukuda. The Examiner takes Official Notice that a dielectric layer (TEOS) is the

equivalent of polysilicon for filling trenches. In the Advisory Action, the Examiner stated that the arguments set forth by the Applicants were not convincing. The Applicants traverse.

As stated previously, Fukuda is directed to a method for forming V-shaped isolation regions. It appears that Fukuda fills a trench with polysilicon material and prevents the formation of an N-channel in the polysilicon (see Constitution, last two lines) by forming a nitride isolation layer 12'. The nitride layer 12' remaining in the trench provides extra isolation between the conducting polysilicon 5 and a P type semiconductor region in a semiconductor substrate 10 (see Purpose of Fukuda). As is known in the art, a P-well is generally located a greater depth in a substrate. It is believed by the Applicant that the title of Fukuda, "Forming Method for V-shaped Isolation Region" refers only to the nitride piece 12' left remaining only in the bottom of the trench.

It appears that this nitride layer 12' provides additional isolation between the P type region below and the polysilicon above to prevent interaction therebetween. It is known in the art that polysilicon is a conductor. This is supported by VLSI Technology, Second Edition, by S.M. Sze on page 233, a copy of which was submitted with the previous response. It is submitted that one skilled in the art would not use a conductive material to form an electrical isolation region. It is not understood why the Examiner has stated that this argument is not convincing since Fukuda clearly states that the V-shaped trench is filled with polysilicon. The polysilicon of Fukuda may be a metal line or other conductive component. Further, polysilicon is not an oxide either. Silicon dioxide is a dielectric material which may have several forms, none of which are polysilicon which is comprised of a plurality of silicon crystals. In fact it is submitted that Fukuda teaches away from the present invention since Fukuda teaches forming polysilicon in the trench while the present invention teaches preventing polysilicon from entering the trench. Still further, it appears that Fukuda does not suggest an isolation region disposed adjacent transistor device having a channel where the nitride liner is disposed below this channel.

Wolf is cited by the Examiner to show depths of isolation devices. Wolf does not disclose or suggest a nitride liner below a channel depth, the channel depth being representative of a depth

of a channel associated with a device disposed beside the trench. The devices described in Wolf are known isolation regions with known depths. However, the art cited does not teach or suggest a nitride liner disposed below a transistor channel depth. Wolf does not cure the deficiencies of Fukuda in this respect nor does Wolf cure the deficiencies with respect to filling the trench with polysilicon to provide isolation.

The Applicants' claimed invention, as amended, includes, *inter alia*, an oxide fill disposed above said nitride liner such that said oxide fill extends above the uppermost of said nitride liner to substantially a top surface of said substrate, such that substantially no polysilicon material is disposed within the trench and said nitride liner is disposed below a transistor channel depth of a transistor. The Applicants fill the trench with an oxide and avoid polysilicon from getting into the trench. Fukuda uses a known conductor to fill the trench. Fukuda teaches away from the Applicants' invention.

Fukuda and/or Wolf do not disclose or suggest a nitride liner disposed below a transistor channel depth. The Examiner is reminded that this is a structural feature and that even if the channel depth were 6 inches the nitride liner would still be below this depth. The mere recitation of a depth as the Examiner attempts by employing Wolf does not show that the feature is obvious. Instead, the examiner must show all the claim limitations. To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation to combine the references. Second, there must be a reasonable expectation of success. Third, the prior art combined references must teach or suggest all the claim limitations. (See MPEP 2142). It is respectfully submitted that Examiner has not met the basic criteria. Even if, *arguendo*, motivation exists to combine the references all of the claim limitations have not been shown, as described above.

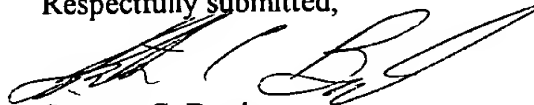
The Examiner takes Official Notice that polysilicon and TEOS are equivalents for filling a trench. This is completely incorrect. The Applicants respectfully request that the Examiner support the Official Notice, i.e., that polysilicon and oxide/TEOS are equivalents, with a reference. It appears that Fukuda does not disclose or suggest an isolation structure for reducing

charge trapping. Instead, Fukuda appears to provide an isolation layer 12' which provides an additional barrier of protection between the polysilicon 5 in the trench and the P-well below the trench. The Applicants' invention provides a solution to charge trapping of isolation regions adjacent to active devices. The structure claimed by the Applicant is not disclosed or suggested by the cited references, either alone or in combination.

The afore-mentioned fundamental differences between Fukuda and Wolf and the presently claimed invention provide sufficient basis to reverse this rejection and allow the claims of the present invention. The cited references either alone or in combination do not teach or suggest a shallow trench isolator which includes, *inter alia*, an oxide fill disposed above said nitride liner such that said oxide fill extends above the uppermost of said nitride liner to substantially a top surface of said substrate, such that substantially no polysilicon material is disposed within the trench and said nitride liner is disposed below a transistor channel depth of a transistor. Accordingly, withdrawal of the rejection of claims 1 and 8 is respectfully requested for at least the reasons stated. The remaining dependent claims 2-5, 7 and 10 are also believed allowable for at least the reasons stated and based on their dependencies. New claims 24 and 25 are believed allowable for the same reasons.

In view of the foregoing amendments and remarks, it is respectfully submitted that all the claims now pending in the application are in condition for allowance. Early and favorable reconsideration of the case is respectfully requested.

Respectfully submitted,



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